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The Journal of Political Economy, Vol. 82, No. 5 (Sep. - Oct., 1974), 905-926.

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Social Security, Induced Retirement, and Aggregate Capital Accumulation

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For the great majority of Americans, the most important form of household wealth is the anticipated social security retirement benefits. In 1971 the aggregate value of these annuities was approximately \$2 trillion or some 60 percent of other household assets. This paper uses an extended life-cycle model to analyze the impact of social security on the individual's simultaneous decision about retirement and saving. Econometric evidence, using an estimated time series of "social security wealth," indicates that social security depresses personal saving by 30–50 percent. Implications of this research for the theory of consumption and for the level and distribution of income are discussed.

For the great majority of Americans, the most important form of household wealth is the anticipated social security retirement benefits. In 1971 the aggregate value of these annuities was approximately \$2 trillion or some 60 percent of other household assets. Neither the theoretical nor the empirical analysis of household consumption behavior has given adequate attention to the existence and growth of social security.

This paper shows that the effect of social security is very important and is more complex than previous discussions have recognized. Section 1 presents a theoretical analysis that emphasizes the impact of social security on the individual's simultaneous decision about retirement and saving. In contrast to previous models of life-cycle saving, the extent of retirement is endogenous. Section 2 discusses the use of an aggregate consumption

This paper is part of a larger study of the effects of fiscal policies on capital formation and income distribution. I am grateful to the National Science Foundation for financial support, and to Roger Gordon, Alicia Munnell, and Anthony Pellechio for assistance with this research. I have also benefited from discussions and comments on a previous draft by Henry Aaron, John Flemming, Milton Friedman, Thomas Mayer, Franco Modigliani, Richard Musgrave, and the referees of this *Journal*.

[*Journal of Political Economy*, 1974, vol. 82, no. 5]
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function to assess the effect of social security. A key variable in the analysis is an estimated time series of "social security wealth," that is, the present value of the social security annuities to which individuals are entitled. The data sources are described in Section 3, and the parameter estimates are presented in Section 4. The evidence indicates that social security has substantially decreased aggregate capital accumulation; specific estimates are presented in Section 5. A final section discusses some of the implications for the level and distribution of income.

I. A Life-Cycle Model with Induced Retirement

Ever since Harrod's (1948) discussion of "hump saving," economists have recognized the importance of saving during working years for consumption during retirement.¹ Although there are a variety of other motives for saving, the life-cycle hypothesis provides a particularly suitable framework for discussing the effects of social security. The most obvious implication of this familiar model is that social security, by providing income during retirement, reduces the amount of saving during the working years. More specifically, if the combination of social security tax and benefits has no net income effect, that is, if the individual's lifetime budget constraint is unchanged, savings will be reduced by just enough to leave consumption during retirement unchanged.

The possible importance of social security has been recognized but has never been formally incorporated into the theoretical or empirical analysis of the life-cycle model. Friedman (1957, p. 123) noted that social security "would clearly tend to reduce the need for private reserves and so to reduce private savings" but made no allowance for this in his analysis of both aggregate and cross-section savings. The potential effect of social security has also been ignored in Modigliani's own tests of the life-cycle hypothesis using time-series data for the United States (Ando and Modigliani 1963) and aggregate data for a cross-section of countries (Modigliani 1970). Mayer's (1972) recent book provides an extensive review of previous studies of the life-cycle hypothesis but no examples of studies in which the effect of social security had been considered.²

¹ As Harrod explicitly recognized, Fisher (1930) provided the basic model of consumption behavior from which his own analysis is derived. Harrod's contribution was to relate Fisher's two-period model to the stages of the life cycle and to explore some of its implications for Keynesian macroeconomics. The Modigliani-Brumberg (1954) paper extended this to a more general multiperiod analysis and derived the implications for the effects of wealth on consumption.

² In a cross-section study of savings in different countries, Aaron (1967) found evidence that higher social security benefits decreased private saving. His basic equation is inconsistent with the life-cycle hypothesis, ignoring variables such as the growth rates of income and of population that would be important determinants of intercountry differences in savings (see Modigliani 1970). This may explain why Aaron later reported that,

In contrast to the implications of the life-cycle theory, students of social security have generally argued that social security is not likely to have a substantial effect on personal savings and that it might even cause such savings to increase.³ This conclusion is based largely on the evidence of Katona (1964) and Cagan (1965) that persons covered by private pensions do not save less and may save more than those persons not covered by pensions. More specifically, Cagan analyzed data generated by a mail survey of *Consumer Reports* subscribers and found that the average savings rate was slightly higher for those with pensions than for those without and was also higher for those with vested pensions than for those whose pensions were not vested. A regression equation implied that an increase in the individual's rate of pension contribution was associated with a higher level of direct ("discretionary") saving. Katona analyzed data collected by a University of Michigan survey of randomly selected households and also found that participation in a pension plan raised savings rates when age and current income were taken into account.

Cagan explained his surprising results in terms of a "recognition effect": when an individual is forced to participate in a pension plan, he recognizes for the first time the importance of saving for his old age. Participation in a pension plan has an educational effect; more formally, it changes the individual's utility function as he perceives it *ex ante* during his working years. Katona added to this a second explanation: the "goal gradient" hypothesis borrowed from psychological research on the forming of aspirations. According to this theory, "effort is intensified the closer one is to one's goal" (Katona 1964, p. 4). In more conventional economic terms, this would imply that individual preferences are themselves a function of the opportunity set or of the initial position, a dramatic departure from the usual assumption of economic analysis.

The findings of Cagan and Katona can be explained without invoking a recognition effect or a model of changing preferences by extending the life-cycle model to make the extent of retirement endogenous. Workers who are covered by pensions have an incentive to retire earlier than they otherwise would. To receive a pension requires retiring from a current job and generally involves loss of union seniority. Even if the individual is permitted to draw the pension after taking a new job, the loss of

when his equation was reestimated with data for a different year, the earlier effect of social security was no longer significant (Aaron 1968). A more recent international study using an extended life-cycle model to assess the impact of social security found that higher social security benefits and broader coverage do substantially reduce private savings (see Feldstein 1974).

³ Sec, e.g., Pechman, Aaron, and Taussig (1968). Ever since Harris's (1941) study, estimates of the effect of social security on savings have concentrated on the impact of the reduction in disposable income (because of the payroll tax) rather than the life-cycle wealth effect of social security. For a more recent example of this, see Tax Foundation (1967).

seniority and of job-specific skills generally entails a substantial fall in the available wage. The pension therefore acts as a combination of an annual lump sum grant and a tax on earnings after the standard retirement age. The result is to reduce the labor supply of pension recipients, generally through earlier retirement. The pension, therefore has two effects on personal savings: (1) it reduces personal saving because it substitutes for household assets, but (2) it also increases personal saving because it lengthens the period of retirement over which accumulated assets will be spread. The net effect of the pension depends on the relative strength of these two forces.

Social security has a similar dual impact. The "tax" on earnings after age 65 is higher and even more obvious than with private pensions. The "earnings test" in the current social security law provides that a potential recipient loses his social security benefits if he earns more than \$2,400 per year, thus requiring retirement from regular employment as a condition of receiving benefits. For an individual who in the absence of social security would have retired at age 65 to consume the income and principal of his accumulated assets, the social security benefits have the unambiguous effect of reducing saving. For those who would otherwise have worked beyond age 65, social security would generally (but not always) induce retirement at an earlier age. For such individuals, the effect of social security on savings is uncertain. In the extreme case of the individual who planned to work as long as he was able and then to be supported by his children or at public expense, the inducement to plan an early retirement could only increase savings. Although additional cases could be distinguished, it is already clear that the two countervailing effects make the net impact of social security ambiguous.⁴

The dual effect of social security is illustrated in figure 1. The horizontal axis measures income and consumption before age 65 (Y_1 and C_1), and the vertical axis measures income and consumption after that age (Y_2 and C_2). For simplicity, pretax income before age 65 is assumed to be unaffected by the introduction of social security. Consider first an individual who in the absence of social security would be fully retired after age 65. His earnings are described by point A : Y_{1A} in period 1 but zero in period 2. Faced with an opportunity to save at the rate of interest implied by the budget line through point A , the individual chooses the pair of consumption levels denoted by point I . During his preretirement period, he

⁴ The introduction of social security also had the effect of removing a peculiar "tax" on savings by low-income individuals. Before social security, an individual could generally receive support at public expense only after he had exhausted all of his own assets. For the individual whose income was so low that a reasonable rate of saving during working years permitted a level of retirement consumption little better than that provided by public assistance, there would be a strong incentive to save nothing. In the same way, aged persons who lived with their children might find that their own assets, if any, did not alter retirement conditions and, therefore, were in effect taxed away.

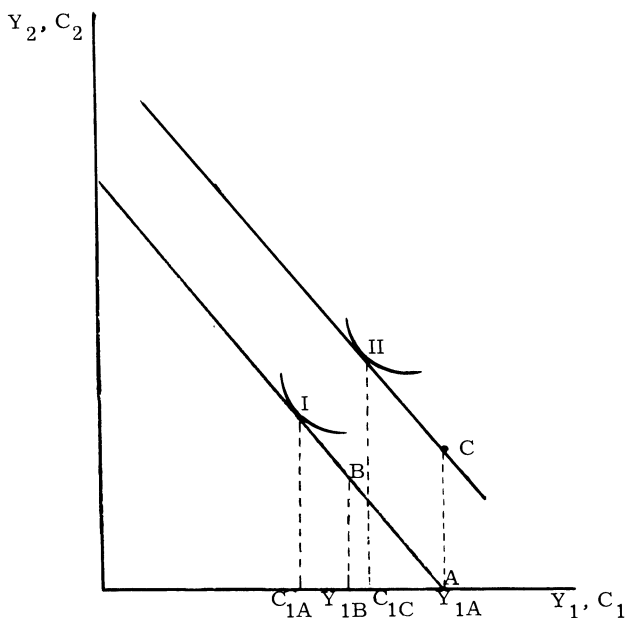


FIG. 1

consumes C_{1A} and saves $Y_{1A} - C_{1A}$. Point B describes that individual's initial position after the introduction of a social security tax; his second-period income is raised by the amount of the benefit, and his first-period income is reduced by the payroll tax to Y_{1B} ; the difference between Y_{1A} and Y_{1B} is just sufficient to finance the benefits at the market rate of interest. Since the introduction of social security does not alter this individual's budget line, he retains the original equilibrium consumption point (I). The reduction in disposable income implies that saving is reduced from $Y_{1A} - C_{1A}$ to $Y_{1B} - C_{1A}$, that is, by the amount of the tax ($Y_{1A} - Y_{1B}$).

This reduction in saving can be contrasted with the experience of an individual who in the absence of social security would continue to work for some time after age 65. Point C indicates an initial position with positive earnings in the second period and the same level of first-period earnings as point A . The new equilibrium consumption pair is denoted by point II; first-period consumption is C_{1C} , and the corresponding saving is the relatively small amount $Y_{1A} - C_{1C}$. If the social security program induces him to retire completely at age 65, his initial position shifts from C to B , that is, his period 1 disposable income is reduced by the amount of the payroll tax, while his period 2 disposable income falls because earnings are reduced to zero and not fully replaced by social security benefits. With initial position B , the individual chooses con-

sumption pair I.⁵ The effect of introducing social security is, therefore, to change savings from $Y_{1A} - C_{1C}$ to $Y_{1B} - C_{1A}$. The current figure is constructed to make $Y_{1B} - C_{1A} > Y_{1A} - C_{1C}$, that is, the introduction of social security increases saving. Alternative assumptions about the consumption-expansion path could yield different results.

These two examples are sufficient to illustrate how social security will increase savings by some and decrease savings by others. A more general mathematical analysis of the effect of social security in the extended life-cycle model shows⁶ that, *if the labor supply is fixed in both periods*, the introduction of a social security program reduces personal saving even if there are positive second-period earnings. When the labor supply in the second period is endogenous, social security benefits reduce second-period labor (i.e., induce earlier retirement), but the effect on savings is ambiguous.

As is so often the case, a theoretical analysis can illuminate the ways in which a public policy affects individual behavior, but it cannot yield an estimate of the magnitude of the effect nor even an unambiguous conclusion about its sign. For this we must turn to an empirical investigation. A full study of this issue would require examining the effect of social security on retirement plans in different circumstances and of the dependence of individual savings on both the retirement plans and the expected social security benefits. The task of the current study is more modest: to assess how the introduction and growth of social security have affected aggregate personal saving and the national accumulation of capital.

II. An Aggregate Consumption Function with Social Security Wealth

To assess the effect of social security, I have adapted the specification of the consumption function used by Ando and Modigliani (1963) and have added a social security wealth variable. The starting point for the analysis is thus:

$$C_t = \alpha + \beta_1 Y_t + \gamma_1 W_{t-1}, \quad (1)$$

where C_t is consumer expenditure, Y_t is permanent income (specified below as a distributed lag on past values of disposable income),⁷ and W_t

⁵ The indifference curves through points I and II are not comparable. The second individual prefers point I to point II because I is associated with not working after age 65.

⁶ This analysis is presented in Feldstein (1974).

⁷ Ando and Modigliani originally used *labor* income only but, because of the difficulties of defining and measuring disposable labor income, Modigliani (1971) has more recently abandoned labor income and used total disposable income. Ando and Modigliani also introduced an adjustment for unemployment. Although the use of a permanent income variable can serve this purpose, the unemployment rate will be examined explicitly.

is the stock of household wealth at the end of year t (excluding social security wealth).

Equation 2 introduces the social security wealth variable (SSW_t) into this consumption function:

$$C_t = \alpha + \beta_1 Y_t + \gamma_1 W_{t-1} + \gamma_2 SSW_t. \quad (2)$$

Two different definitions of SSW are used in the current study. Gross social security wealth ($SSWG_t$) is the present value in year t of the retirement benefits which could eventually be claimed by all those who are either in the labor force or already retired in year t . The calculation of these present values reflects survival probabilities as well as the discounting of future receipts. Net social security wealth ($SSWN_t$) equals gross social security wealth minus the present value of the social security taxes to be paid by those who are currently in the labor force. Net social security wealth is positive because the social security program involves a transfer to those who are currently working or retired from those who are yet to enter the labor force.

Since disposable income already excludes social security taxes, the gross social security wealth variable is probably the correct specification. Using the net social security wealth is equivalent to taking into account not only the current payroll tax but the present value of all future taxes. This is more appropriate if one views the social security program as creating for each individual an amount of wealth equal to the present value of the difference between his future benefits and his future taxes. The consumption function has been estimated with both definitions. Fortunately, both sets of estimates have the same implications.

The basic logic of the calculations used to evaluate $SSWG$ and $SSWN$ can be explained briefly.⁸ Consider an unmarried worker who is age a in year t . If he remains single and survives to age 65, he will be entitled to an annual social security benefit in the amount $b_{a,t}$. In estimating the average value of future benefits for a single surviving annuitant, it would be wrong to assume that the schedule of benefits provided by law in year t would remain in effect. The history of social security shows continually rising benefit levels, a fact that individuals no doubt perceive when they contemplate the order of magnitude of their own benefits at retirement age. The ratio of annual benefits for retired workers (excluding dependents' benefits) to per capita disposable income has varied without any trend around a mean level of 0.41. The current calculation assumes that $b_{a,t}$ is 0.41 times per capita disposable income in year $t + 65 - a$ when the individual retires, Y_{t+65-a} . Finally, this future value of disposable income is estimated by projecting the current level at a constant rate of growth of disposable per capita income, $Y_{t+65-a} = Y_t(1 + g)^{65-a}$.

⁸ A full description of the algorithm used is available from the author.

The anticipated benefits at age 65 are thus $b_{a,t} = 0.41 Y_t(1 + g)^{65-a}$. During his retirement, the annual benefit will continue to grow. For simplicity we assume that this growth also occurs at rate g ; thus at age $n > 65$, his annual benefit is $b_{a,t}(1 + g)^{n-65}$.

Let $S_{i,j}$ denote the probability that a man age i survives to at least age j , and let d be the rate at which the individual discounts expected future benefits. At age 65, his social security annuity will have a value of

$$\sum_{n \geq 65} S_{65,n} b_{a,t} (1 + g)^{n-65} (1 + d)^{-(n-65)};$$

for practical purposes the sum may be truncated at age 100. At time t (when the individual is age a) the future annuity has value:

$$A_{a,t} = S_{a,65} (1 + d)^{-(65-a)} \sum_{n \geq 65} S_{65,n} b_{a,t} (1 + g)^{n-65} (1 + d)^{-n+65}.$$

After substituting for $b_{a,t}$ we obtain:

$$\begin{aligned} A_{a,t} &= 0.41 Y_t S_{a,65} [(1 + g)/(1 + d)]^{65-a} \\ &\quad \times \sum_{n \geq 65} S_{65,n} [(1 + g)/(1 + d)]^{n-65}. \end{aligned} \quad (3)$$

Analogous calculations are done for single women, for working wives, and for married couples in which only the husband works. The special benefit rules for wives and for working women are reflected in these calculations. In particular, the value of the annuity for a married worker includes the benefits paid to his surviving spouse. The value of $SSWG_t$ is the weighted sum of the $A_{a,t}$ values for each type of worker and for each age group, weighting by the numbers of workers of that type and age covered by social security in year t .⁹

The present value of future social security taxes is obtained by a similar method. A worker who contemplates his future social security taxes recognizes that they will rise because of increases in both the tax rate and the level of taxable earnings. For simplicity, we combine these and assume that the individual forecasts the ratio of social security taxes per covered worker to per capita disposable income, θ_t . An average worker who is age a in year t pays a tax of $T_t = \theta_t Y_t$, independent of his age. He expects that at age m he will pay a tax of $T_{t+m-a} = \theta_{t+m-a} Y_t (1 + g)^{m-a}$. The present value of all his future taxes until age 65 is thus:¹⁰

$$\text{TAX}_{a,t} = \sum_{m=a}^{64} S_{a,m} \theta_{t+m-a} Y_t [(1 + g)/(1 + d)]^{m-a}. \quad (4)$$

⁹ An adjustment is made for those who are not currently labor-force participants but can be expected to draw social security benefits at some time in the future.

¹⁰ A special adjustment is made for those over age 65 who are still employed.

The value of θ_t has been rising in an irregular pattern since the introduction of social security and in 1971 reached approximately 0.15 for males and 0.07 for females. The current calculations assume that the individuals correctly foresaw the changes in θ_t before 1971 and assumed that after 1971 the θ_t 's would remain at the 1971 levels. The total present value of expected future taxes is a weighted sum of the $TAX_{a,t}$ values for different employee types (single men, married men, etc.) and age groups, weighting by the numbers of covered workers in each group in year t . The net social security wealth value in each year is the difference between $SSWG_t$ and this aggregate tax value.

Despite the complexity of these calculations, the values of $SSWG_t$ and $SSWN_t$ do not have the precision of actuarial estimates. For example, there is no adjustment for future marriages and divorces or for remarriages by surviving beneficiaries. But an exact actuarial estimate is not required for the current analysis. The SSW variable should reflect the magnitude of the effect of social security to which households respond. The household's implicit evaluation of social security benefits is likely to reflect their perception of the current standard of living among social security annuitants and of the way in which this has changed in the past. Note that households may therefore be able to respond appropriately to changes in social security without being able to calculate or articulate the value of benefits.

The SSW variable values the benefits for which individuals are *eligible* at age 65: there is no reduction for the individuals who can be expected to continue to work beyond age 65. In this way, the SSW variable represents both the "substitute asset" effect that would reduce savings and the "inducement to retire" effect that would increase savings. The estimate of γ_2 , therefore, measures the net effect of the introduction and growth of the social security program. It therefore underestimates the effect on saving of the increasing number of individuals who already plan to retire at 65.

The consumption function of equation 2 should be extended to reflect the impact of corporate saving on household consumption. During the period since the introduction of social security in 1937, the growing tax incentive associated with rising marginal personal income tax rates has induced companies to increase the fraction of total earnings that is saved.¹¹ The traditional specification of equation 1 implies that dividends have a much greater effect on concurrent consumption than retained earnings. This implies that the tax-induced substitution of retained earnings for dividends during the past 30 years has reduced household consumption. I believe that this is an unintended result of specifying

¹¹ See Brittain (1966) for evidence that this has occurred. Feldstein (1970) found that British firms also varied their savings rate in response to tax-induced changes in the opportunity cost of retentions in terms of foregone dividends.

consumer behavior without considering the implication of the corporate form of business. The current paper, therefore, relaxes this restrictive assumption and uses a model developed in Feldstein (1973) and Feldstein and Fane (1973) in which retained earnings have a short-run effect on consumption in addition to their long-run wealth effect. More specifically, the basic specification used in this paper is:

$$C_t = \alpha + \beta_1 Y_t + \beta_2 RE_t + \gamma_1 W_{t-1} + \gamma_2 SSW_t. \quad (5)$$

Separate estimates with the retained earnings variable excluded show that this does not substantially affect the estimated impact of social security wealth.

III. The Data

The estimates presented below are based on aggregate U.S. data for the periods 1929 through 1971, excluding the years 1941 through 1946. Separate analyses for the postwar period, 1947 through 1971, are also presented.

Consumer expenditure (C) and disposable personal income (YD) are the usual national income account values, deflated to constant 1958 dollars and divided by population. The measurement of retained earnings raises a problem because of inadequate data on true economic depreciation. Undistributed profits as reported in the national income accounts are equal to gross profits minus an estimate of corporate capital consumption. Because of the accounting conventions used to calculate capital consumption, this measure of net retained earnings is likely to be an underestimate of true net corporate saving. Gross retained earnings is obviously an overestimate. Separate equations have been estimated with each specification. The similar implications of the results with both measures indicates that further work to improve the measurement of retained earnings would not alter any conclusions. Only the equations with gross retained earnings are reported.

The wealth variable is the per capita net worth of households at market value expressed in 1958 dollars. The series was estimated by Ando and Modigliani (1963) based on Goldsmith's (1956) earlier study and updated for the FRB-MIT econometric model.¹² The variable W_t refers to the wealth at the end of year t .

The basic data required to calculate the social security wealth variable are published in the annual statistical supplements of the *Social Security Bulletin*. Each year the average level of benefits for retired workers is published as well as the average payroll tax per covered employee and

¹² I am grateful to Franco Modigliani for making available the unpublished data.

TABLE 1
SOCIAL SECURITY WEALTH
(BILLIONS OF CONSTANT 1971 DOLLARS)

YEAR	GROSS WEALTH		NET WEALTH		GNP (5)
	<i>SSWG1</i> (1)	<i>SSWG5</i> (2)	<i>SSWN1</i> (3)	<i>SSWN5</i> (4)	
1940	235	70	145	25	321
1950	442	153	227	36	503
1955	690	270	366	81	620
1960	917	380	493	122	691
1965	1,397	596	805	234	875
1971	2,029	875	1,162	342	1,050

the number of covered employees and annuitants by age and demographic group (single men, etc.). Separate survival probabilities ($S_{i,j}$'s) for men and women are obtained from the life tables published by the U.S. Department of Health, Education and Welfare (1968).

The formula for *SSW* also contains the rate of growth of real per capita disposable income (g) and the individual's rate of discount for future real income (d). For the 35 years from the introduction of the social security program to 1972, real per capita disposable income grew at a rate of 2 percent per year. The value of d can be considered the average real rate of interest after tax that was available to savers during the period since the introduction of social security. The nominal rate of interest on Moody's Baa bonds averaged 5.0 percent from 1937 to 1972. The average inflation of consumer prices was 3.0 percent. The real yield before tax was, therefore, 2.0 percent. The yield on bank deposits and savings bonds was lower. Although the return on common stocks and private homes was much higher, investment in common stocks has been relatively unimportant for low- and moderate-income households, and the scope for additional saving in owner-occupied housing is obviously limited. A value of $d = 0.03$, therefore, appears to be an appropriate estimate. Equations 6 and 7 show that g and d always enter together in the form $(1 + d)/(1 + g)$. What matters, therefore, is only this net discount ratio and not the individual values of g and d . The values $g = 0.02$ and $d = 0.03$ imply a ratio of 1.01. To test the sensitivity of the regression analysis to this value, estimates were also made with *SSW* calculated with the very high ratio of 1.05. Although 1.05 produces much smaller values of *SSW*, the choice of discount ratio does not alter the implications of the regression estimates.

Table 1 presents values of gross and net social security wealth at six dates; the *SSW* values are converted to constant 1971 dollars by the implicit price deflator for personal consumption expenditures. The choice

of discount factor is indicated by a final number in the name of the variable, for example, *SSWG1* refers to the gross social security variable computed using a net discount ratio of 1.01. Note that by 1971 the value of *SSWG1* was more than \$2.0 trillion in constant 1971 dollars, and the value of *SSWN1* was more than \$1.1 trillion. This compares with total household assets of \$3.5 trillion. The social security wealth increases household assets by 60 percent according to the gross definitions and 30 percent according to the net definition.¹³

A comparison of the *SSW* variables with real GNP (presented in col. 5 of table 1) shows that social security wealth has grown much more rapidly. This reflects a substantial aging of the population and, more important, an increase in the proportion of workers covered by social security from 58 percent of paid employees in 1940 to 89 percent in 1971.

For the regression analysis the *SSW* values are all divided by population. By construction they are already in constant 1958 dollars.

IV. Estimates of the Effect of Social Security Wealth

The estimates presented below support the conclusion that social security substantially depresses personal savings. The marginal propensity to consume social security wealth is generally statistically significant and slightly larger than the propensity to consume ordinary wealth. This difference probably reflects the fact that a large portion of ordinary wealth is held by a small fraction of households for whom bequests and the accumulation of larger fortunes are more important than saving for retirement. Although the coefficient of *SSW* depends on the choice of definition and discount rate, Section 5 will show that nearly all of the estimates imply that, in the absence of social security, personal savings would be at least 50 percent higher than they are now and probably closer to 100 percent higher.

Equation 2.1 of table 2 presents an estimate of the consumption function with gross social security wealth and a discount ratio of 1.01 (*SSWG1*).¹⁴ The marginal propensity to consume *SSWG1* is 0.021 with a standard error of only 0.006. The other coefficients are of the expected size: 0.650 for disposable income¹⁵ and 0.014 for household wealth. The marginal propensity to consume gross retained earnings (0.36) is approximately equal to the value of 0.50 reported in Feldstein (1973) for an

¹³ Although the other measures of *SSW* are lower, they are based on less acceptable assumptions about the valuing of *SSW*.

¹⁴ Recall that the discount ratio is defined as $(1 + d)/(1 + g)$, where d is the individual's rate of discount and g is the rate of growth of real per capita income.

¹⁵ The value of 0.650 may appear low as an estimate of the long-run marginal propensity to consume. It should be remembered, however, that the equation contains wealth and retained earnings variables. If these are omitted, the coefficient of income rises substantially.

TABLE 2
CONSUMPTION FUNCTIONS WITH SOCIAL SECURITY WEALTH

Eq.	Period*	SSW Definition	YD	YD ₋₁	RE	W ₋₁	SSW	RU	Const.	SSR	D-W Statist.
2.1	1929-71	SSWG1	0.530 (0.047)	0.120 (0.035)	0.356 (0.074)	0.014 (0.004)	0.021 (0.006)	...	228 (31)	3,618	1.82
2.2	1929-71	SSWN1	0.528 (0.047)	0.137 (0.034)	0.376 (0.073)	0.013 (0.004)	0.032 (0.009)	...	218 (27)	3,548	1.85
2.3	1929-71	SSWG5	0.530 (0.048)	0.136 (0.035)	0.400 (0.075)	0.008 (0.005)	0.051 (0.016)	...	244 (37)	3,714	1.82
2.4	1929-71	SSWN5	0.538 (0.049)	0.163 (0.037)	0.432 (0.079)	0.009 (0.006)	0.075 (0.027)	...	204 (29)	3,944	1.71
2.5	1929-71	SSWG1	0.675 (0.047)	0.046 (0.041)	...	0.009 (0.005)	0.024 (0.008)	...	204 (40)	6,289	1.43
2.6	1929-71	SSWG1	0.553 (0.050)	0.154 (0.043)	0.436 (0.096)	0.013 (0.004)	0.010 (0.011)	1.170 (0.892)	155 (64)	3,422	1.80
2.7	1929-71	SSWG1	0.549 (0.047)	0.149 (0.037)	0.423 (0.079)	0.012 (0.004)	0.012 (0.004)	1.020 (0.663)	169 (30)	3,430	1.82
2.8	1947-71	SSWG1	0.535 (0.097)	0.139 (0.097)	0.414 (0.163)	0.015 (0.009)	0.014 (0.030)	...	193 (159)	3,087	1.63
2.9	1947-71	SSWN1	0.535 (0.084)	0.119 (0.085)	0.349 (0.170)	0.014 (0.007)	0.035 (0.030)	...	232 (104)	2,926	1.78
2.10	1947-71	SSWG1	0.531 (0.098)	0.106 (0.105)	0.423 (0.164)	0.008 (0.012)	0.029 (0.035)	2.786 (3.237)	252 (175)	2,965	1.80

* The years 1941-46 are excluded from the sample. The Durbin-Watson statistic is adjusted for this gap. Standard errors are shown in parentheses.

equation that ignored the effect of social security and that was limited to the period 1929 through 1965.¹⁶

Using the *net* definition of social security wealth or a higher discount ratio strengthens these conclusions. Equations 2.2 through 2.4 show that alternative measures of *SSW* leave the other coefficients unchanged but increase the size of the propensity to consume social security wealth. These differences in the coefficient of *SSW* are primarily due to differences in the magnitudes of the *SSW* measures. Comparing these coefficients with the *SSW* values presented in table 1 shows that all four equations imply approximately the same effect of security wealth on consumption.

Although the retained earnings variable has a stable and statistically important coefficient, its novelty in the consumption function may raise doubts about its effect on the coefficients of the other variables. Equation 2.5 shows that excluding *RE* causes a slight increase in the coefficient of the *SSW* variable. The results are similar when a higher discount ratio is used.

Equations 2.1 through 2.5 were estimated by ordinary least squares and are therefore subject to possible simultaneous equation bias. Reestimating these equations with a consistent instrumental variable procedure confirmed the original ordinary least-squares results.¹⁷ For example, with *SSWG1* the coefficient of *SSW* was increased from 0.021 in equation 2.1 to 0.033 with the instrumental variable estimator. The coefficient of the retained earnings variable also rose, from 0.356 in equation 2.1 to 0.501 with the instrumental variable estimator. There was some indication of substantial simultaneous equation bias in the estimated effect of disposable income; the sum of the coefficients fell from 0.650 in equation 2.1 to 0.561 with the instrumental variable estimator.

An alternative dynamic specification of permanent income also leaves the other coefficients unchanged. More specifically, a permanent income variable was defined by the recursive relation $YP_t = (1 - \mu)YD_t + \mu YP_{t-1}$. A maximum-likelihood estimate was obtained by doing ordinary least squares conditional on values of μ between zero and one and selecting that value of μ that minimizes the sum of squared residuals. For a specification analogous to equation 2.1, the maximum-likelihood estimate of μ was 0.18, implying a rapid response that can be well represented by the 2-year distributed lag. The long-run marginal propensity to consume disposable income was 0.65, and the other coefficients were almost unchanged from the 2-year distributed lag specification of equation 2.1: 0.35 for retained earnings, 0.014 for wealth, and 0.021 for *SSWG1*.

¹⁶ Since the R^2 values are extremely high for all equations ($R^2 \geq .99$), only the sum of squared residuals and the Durbin-Watson statistic are presented.

¹⁷ The instrumental variables were government expenditure, exports, money supply, household wealth, and the social security wealth variable.

While the use of a distributed lag on past incomes is the most common way of relating consumption to "permanent" income, the rate of unemployment has often been included in the consumption function to adjust for the cyclical variation in the relation of consumption and income.¹⁸ Introducing the unemployment rate (RU) in equation 2.6 lowers the coefficient of SSW and increases its standard error. However, the coefficient of RU is not statistically significant and is absolutely very small. More specifically, the coefficient implies that even a 5-percentage-point increase in RU would raise consumption by less than \$6.00, that is, doubling the unemployment rate would raise consumption by much less than 1 percent.¹⁹ Equation 2.7 shows that the insignificance of the unemployment coefficient is not merely due to its collinearity with the social security wealth variable. Instead of estimating separate coefficients for personal wealth and SSW , the two coefficients are constrained to be equal; the coefficient of RU is still insignificant, while the coefficient of the total wealth variable is more than three times its standard error.

The apparent collinearity of the RU and SSW variable also raises the possibility that the social security variable (which is zero before 1937) is only a reflection of the shift in consumption behavior from the prewar to the postwar period. To test this possibility, the consumption equations have been reestimated with data restricted to the postwar period (1947 through 1971). The results reject this explanation and support the original conclusion that social security substantially depresses personal savings. In equation 2.8, the coefficient of $SSWG1$ is somewhat smaller than the corresponding coefficient for the entire period, while in equation 2.9 the coefficient of $SSWN1$ is somewhat larger than for the entire period; comparing the residual sums of squares again indicates a slight preference for the net worth measure and, therefore, the larger coefficient. Introducing the unemployment rate (eq. 2.10) substantially raises the estimated effect of $SSWG1$, while the coefficient of the unemployment variable is itself statistically insignificant. In short, although the smaller variation of SSW in the postwar period than in the entire sample raises the standard errors of its estimated coefficient, these coefficient estimates are similar to the values for the entire interval.

V. The Impact on Aggregate Saving

While the coefficients of table 2 must be regarded with caution, it is interesting to examine the implications of these parameter values for aggregate savings. In equation 2.1, the marginal propensity to consume disposable income is 0.650, and the marginal propensity to consume social

¹⁸ See Ando and Modigliani (1963) for the rationale for using the unemployment rate and the recent level of income to represent expected future income.

¹⁹ Real per capita consumption rose from \$1,145 in 1929 to \$2,393 in 1971.

security wealth is 0.021. In 1971, social security taxes and contributions reduced disposable income by \$51 billion in 1971 prices. The corresponding reduction in personal savings is, therefore, \$18 billion. The social security wealth (*SSWG1*) for 1971 was \$2,029 billion, implying a reduction in saving of \$43 billion. The wealth effect is, therefore, more than twice as important as the tax effect through the reduction in disposable income. The total fall in personal saving was therefore \$61 billion in 1971 prices.²⁰ Since personal saving in 1971 was also \$61 billion, the implied effect of social security is to reduce personal saving to half of what it otherwise would be.²¹ Repeating these calculations for each of the other three definitions of social security wealth yields similar estimates of the reduction in personal savings, ranging from \$44 billion with *SSWN5* to \$63 billion with *SSWG5*.

The implication that social security halves the rate of personal saving is startling but not unreasonable. For middle- and low-income families, social security is a complete substitute for a substantial rate of private saving.²² The asset-substitution effect is, therefore, likely to be very significant. Although social security induced retirements that would otherwise have been postponed, a substantial fraction of older men were already retiring before the introduction of social security. In 1930, 46 percent of men over 65 were retired, while in 1971 this was 75 percent. For the original 46 percent, social security has only an asset-substitution effect. Only for the remaining 25 percent does social security have a stimulating "retirement effect" as well as a depressing asset-substitution effect.²³ The estimates imply that any additional savings that result from induced retirement among this group have been outweighed by the asset-substitution effect among all social security beneficiaries.

Although the coefficient of social security wealth has been treated as a constant in estimating the consumption function, it is more appropriate

²⁰ This slightly overstates the effect on saving because the social security taxes and contributions include funds for Medicare and disability insurance. The calculations implicitly assume that the parameters of the consumption function would be unchanged if consumer expenditure were replaced by the sum of consumer expenditure, interest paid by consumers, and personal transfers to foreigners; the two additional items were only 3 percent of 1971 consumer expenditure.

²¹ Personal saving in 1971 was 9.2 percent of disposable income and thus substantially higher than other years in the postwar period. For the postwar sample period, the average was 6.4 percent. The choice of 1971, therefore, substantially understates the relative impact of social security. Note, however, that the assumption that all social security benefits are consumed may overstate the effect of the program on saving. If instead the propensity to consume these benefits is assumed to be the same as for other forms of disposable income, only the wealth effect would remain. This implies that saving would be reduced by \$43 billion to 59 percent of what it would otherwise be.

²² For an individual with earnings below the covered maximum (\$9,000 in 1972), social security can replace personal savings of at least 10 percent of disposable income.

²³ Note that the 46 percent and 25 percent refer to man-years and not to individuals.

to regard the estimate as an average of the different propensities to consume that prevailed during the sample period. Moreover, it seems likely that the marginal propensity to consume increases in *SSW* will be higher in the future than it has been in the past. The coefficient of *SSW* reflects both the asset-substitution effect and the inducement-to-retire effect. The relative importance of these two countervailing effects will change as the social security program matures. Until recently, social security has been increasing the frequency of retirement among men over age 65. These induced retirements led to additional saving and, therefore, partly offset the asset-substitution effect that gives the *SSW* coefficient its positive sign. Since 75 percent of men and 91 percent of women over 65 were retired in 1971, there is now much less scope for a proportional increase in retirement, and the asset-substitution effect can be expected to dominate even more strongly in the future.²⁴

VI. Some General Implications

The model and empirical estimates presented in this paper have wide-ranging and important implications. Although these cannot be explored here in any detail, the following section will provide some brief remarks about three different issues.

The Theory of Consumption

The analysis lends support to the general idea of life-cycle saving while indicating the importance of extending the traditional model by making the age of retirement an economic decision. The substantial estimated effect of social security wealth on consumption is consistent with this life-cycle hypothesis. By taking into account the effect on saving of induced retirement, the generalized life-cycle model can also explain previous survey evidence on the relation between pensions and household saving without recourse to Cagan's "recognition effect" or Katona's "goal gradient" hypothesis.

Previous tests of the life-cycle model should be reconsidered within this more general framework and with explicit recognition of the role of social

²⁴ Munnell (1973) independently recognized the important effect of changing retirement behavior on aggregate savings. Her study examines the various forces that have altered retirement rates since 1900 and provides an explicit estimate of the positive effect of increasing retirement on personal saving. By using national balance-sheet data to construct savings series, she is able to separate savings in the assets that are most important for the families with low and moderate incomes for whom social security is a primary source of retirement income. Her analysis using the *SSW* series of the current paper provides strong support for the conclusion of this section.

security.²⁵ A measure of social security wealth should also be included in future tests of other hypotheses about consumption behavior.

One of the most firmly established facts about consumer behavior is the long-run constancy of the aggregate savings rate (Kuznets 1946; Denison 1958; David and Scadding 1972). Much of modern consumption theory arose in the attempt to reconcile this fact with other observations about aggregate and individual consumption. The substantial depressing effect of social security on the postwar savings rate raises a serious question about the *behavioral* significance of the observed constancy of the savings rate. The evidence presented in this paper seems more consistent with the Keynesian view that the aggregate rate of saving would increase as income rose if there were no offsetting government policies.

Capital Accumulation and National Income

The evidence that the social security program approximately halves the personal savings rate implies that it substantially reduces the stock of capital and the level of national income. During the 1960s, personal saving accounted for 60 percent of total private saving. By halving personal saving, social security reduced total private saving by 38 percent. In the long run, this decrease in the rate of private saving would also decrease the private capital stock by 38 percent.²⁶

These estimates are consistent with the magnitude of the social security wealth derived in Section 3. The 1971 value of gross social security wealth with the most plausible value of the relative discount ratio ($SSWG1$) was \$2,029 billion in 1971 prices. Total household assets (W) in that year were \$3,474 billion in 1971 prices. The actual level of assets was, therefore, 37 percent less than if all of the social security wealth had instead been saved privately. This is remarkably close to the predicted long-run effect of 38 percent, in spite of conceptual differences between household assets and real capital stock.

A 38 percent decrease in the capital stock implies a substantial reduction in GNP. If this asset substitution had not occurred, the long-run capital stock would be some 60 percent higher.²⁷ A rough approximation of the effect that this greater capital stock would have on national income

²⁵ The possibility that the generalized life-cycle model is appropriate for most of the population but not for the very wealthy should be examined. See Tobin (1967) for an interesting simulation approach to testing the consistency of the life-cycle hypothesis with actual savings, and Mayer (1972) for a survey of previous econometric estimates.

²⁶ Since the social security system is not "funded" but operates on a pay-as-you-go basis, the reduction in private saving is not offset by any increase in public saving. Note that if the tax-transfer process does not reduce saving so that saving falls only because of the wealth effect of the social security program, the decrease in the rate of private saving and therefore in the private capital stock is 29 percent.

²⁷ In providing a "fiat" asset as a substitute for real capital formation, social security is similar to absorbing saving by a growing money supply (see Tobin 1965).

can be obtained by assuming a Cobb-Douglas technology and a capital coefficient of 0.3. With this assumption, GNP is multiplied by $(1.6)^{0.3}$, that is, income would rise by 15 percent. A more conservative assumption of a 40 percent increase in the capital stock implies that GNP would rise by 11 percent. For 1972, this implies that GNP would be increased by more than \$127 billion.

The lower level of GNP reflects the pay-as-you-go nature of our social security system. Because social security contributions are used to pay concurrent benefits, the capital stock is smaller and income is less.²⁸ This result should be contrasted with Samuelson's (1958) important and much misinterpreted analysis of the effect of social security in a "consumption loan" model. Samuelson considered an economy in which real capital accumulation was physically impossible. In his analysis, all commodities were like "chocolates" that melted and could not be stored through time. Private saving required finding a borrower who wished to consume more than his income and could repay at a later time. In this situation, life-cycle saving cannot be carried out efficiently. Samuelson showed that a pay-as-you-go social security system could lead to an unambiguous improvement in welfare; each generation would prefer the social security system to the alternative equilibrium. In this analysis, the assumption that there is no store of value or method of real accumulation is crucial. As Samuelson notes, simply introducing a stock of fiat money to provide a store of value makes it unnecessary to create a social security system in order to achieve intertemporal efficiency. Allowing for the accumulation of productive capital goods makes the analysis more complex and, as shown here, implies that a pay-as-you-go social security system reduces aggregate saving and lowers the level of real income.²⁹

The Distribution of Income

Analyses of the distributional impact of social security have focused on two questions. First, how do the taxes nominally paid by persons at different income levels compare with the benefits that are eventually received?³⁰ Second, how does the payroll tax affect gross factor prices,

²⁸ Note that this lower level of income does not measure lost welfare because some additional consumption was obtained at an earlier date. An analysis of the welfare loss would require a cardinal social utility function capable of intergenerational calculations of time preference.

²⁹ As Aaron (1966) has noted, a pay-as-you-go social security system can lead to an unambiguous welfare increase in an economy that would otherwise save too much, that is, in the unlikely case of an economy that is so capital intensive that the rate of return is less than the rate of growth of real output.

³⁰ The system has been shown to pay a rather high implicit rate of interest on these taxes, with relatively higher yields going to those at lower income levels (see Brittain 1972). The redistributive impact is generally understated by ignoring the fact that higher-income individuals are much less likely to retire at age 65.

that is, what is the incidence of the tax? This paper indicates that the benefits side of the social security program also has important effects on the distribution of income. Two separate issues can be distinguished: the changes in factor prices, and the effects on the income of the aged.³¹

The substantial reduction in the capital stock that results from the current social security program decreases wage rates and increases the rate of profit. To obtain an order of magnitude for these effects, I will again assume a Cobb-Douglas technology with a capital elasticity of 0.3. With a fixed labor supply, the wage rate is proportional to $K^{0.3}$ (where K is the capital stock), and the rate of interest is proportional to $K^{-0.7}$. If, in the absence of the current social security system, the capital stock were 60 percent greater, the wage rate would rise by 15 percent and the rate of interest would fall by 28 percent. Although the Cobb-Douglas technology implies that factor shares would be unchanged, there would be a substantial redistribution of capital income to those who, because of the social security system, now save very little.

The induced retirement implies that the labor supply is also decreased by the social security system. Less labor raises the wage rate and lowers the rate of return.³² This partly offsets the distributional effect of the change in the capital stock. But even if all of the increase in retirements since 1930 were attributed to social security, the reduction in the labor supply would be quite small in comparison to the reduction in the capital stock. More specifically, if the labor force participation rates of those over 65 were at the 1930 values, the labor force in 1970 would be increased by less than 3 percent.³³ The net effect of the changes in capital and labor has clearly been to raise the rate of profit and lower the wage rate.

Although the social security program was intended primarily as a system of income maintenance for the aged, it may now have the effect of reducing the levels of income and consumption for many of those over 65. Those who are induced by the combination of available benefits and the "earnings test" to retire earlier than they would otherwise have done generally receive substantially less in social security benefits than they would have earned if they had continued to work. As the analysis of Section 1 showed, even with optimal savings during the preretirement years, the level of consumption is likely to fall at retirement. The income-

³¹ By replacing individual saving, social security also has a substantial effect on the distribution of wealth. If each household's social security wealth were added to its other assets, the distribution of total wealth would be much more equal than the distribution of wealth as traditionally defined.

³² A reduction in labor supply through earlier retirement has a different long-run effect on factor prices than a proportional reduction in the quantity of labor supplied each year with no change in retirement. In particular, these two changes in labor supply have different effects on savings behavior (see Feldstein 1972).

³³ Future increases in the level of social security benefits will have relatively little effect on the labor supply since 74 percent of men over 65 are already retired.

maintenance goal of the social security program is thus partly vitiated by imposing an earnings test as a condition for receiving benefits.³⁴

VII. Conclusion

It is best to conclude this paper with a caveat. The substantial estimated effect of social security on personal savings is based on aggregate time-series data for a single country. The results are consistent with the generalized life-cycle hypothesis but require further analysis with different sets of data. Work is currently in progress to examine household data for the United States and aggregate data for a cross-section of countries. Additional studies for individual countries, using both aggregate time series and household surveys, could be of great value in testing the current conclusions.

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